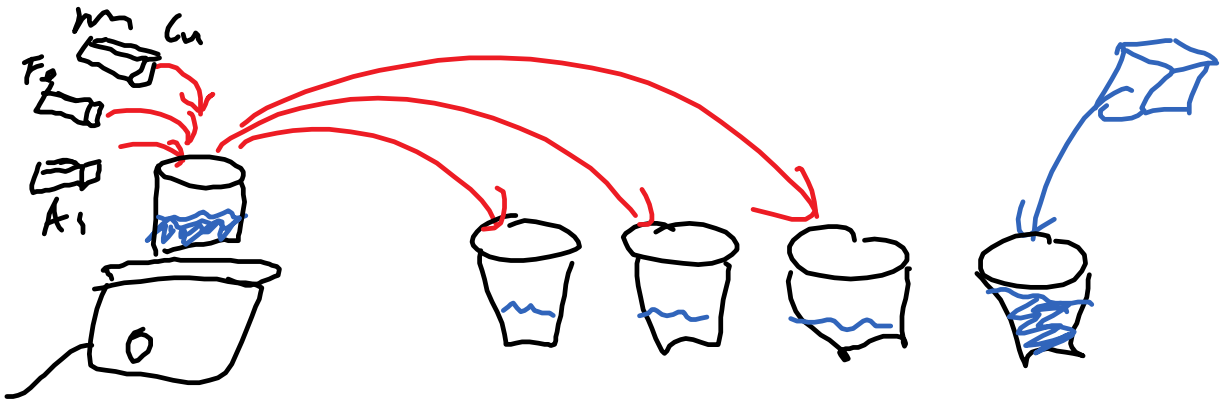
Internal Energy Lab

Procedure:

Find mass of 3 metals



hotplate
beaker
3metals

4 cups with water
find mass and initial temp
add hot metals and ice -
measure final temperature

Observations:

Substance	mass metal or ice	mass water in cup	initial temp water in cup	final temp water in cup
Fe				
Al				
Cu				
ice				

temp of boiling water

Zeroith Law of Thermodynamics

- Heat flows from the higher temperature object to the lower temperature object only.

- results from First and Second Law.

First Law of Thermodynamics
- Restatement of conservation of energy law.
- $\Delta U=W+Q$
  change in internal energy = work done on the system + the heat into the system

Second Law (engineering option)
- Entropy increases unless work is done. Overall entropy always increases.
- Entropy is measure of disorder, S.

Lab
for an insulated system - no heat in or out - no work

$\Delta U = 0 = Q_A + Q_B$ for object A and B
more commonly
$Q_A = -Q_B$
heat gained by A = heat lost by B

If there are no changes in state,
$m_A c_A \Delta T_A = -m_B c_B \Delta T_B$

For the lab, solve for c of each metal

what about ice?
ice melts and then warms to equilibrium temperature
$m_A H_f + m_A c_A \Delta T_A = -m_B c_B \Delta T_B$

melt

solve for H_f from your lab data

assume c=4180J/kgºC for water
and no heat lost to air/thermometer/cup

Formal lab writeup

Quiz next class gas laws and Heat

p466 Q41

PV=nRT = constant
P proportional to 1/V
if V is 1/10, then P icreases10 times (inverse)
101.3 x 10 = 1,013 kPa = 1.0 MPa

p501
Q51
m of 1000cm^3 of ice is about 1kg
Q= mHf = about 1kg x 3.3 x 10^5 = about 3x10^5J

0.9340 g = 1cm^3
1000x0.934=934 g
0.934x3.3E5=308,220 J = 3.1x10^5J